

### **CLAIMS**

- 1 A method of laser trepan drilling diffuser type holes in a workpiece having a wall defining an internal cavity, the said method comprising the steps of:  
laser drilling a hole of substantially constant cross-section through a wall of the workpiece;  
directing the beam of the laser such that the beam follows a path on at least one side of the hole to drill a diffuser section on at least the beam entry side of the hole with the beam exiting the hole substantially without interference with the remaining non-diffuser part of the hole.
- 2 A method as claimed in Claim 1 wherein the diffuser section is cut with a generally elongate opening on the beam entry side of the hole, with the beam being inclined with respect to the longitudinal axis of the hole, and with respect to the elongate axis of the said opening being formed on the beam entry side of the wall such that the beam is directed substantially wholly into the interior of the hole as it passes therethrough.
- 3 A method as claimed in Claim 2 wherein the beam is inclined with respect to the elongate axis of the opening by an angle determined by at least the dimensions of the said opening.
- 4 A method as claimed in Claim 3 wherein the said angle is determined by the dimensions of the periphery of the said opening.
- 5 A method as claimed in claim 1 wherein the said hole is in the form of an EDM fan type cooling hole in a gas turbine engine component.
- 6 A method as claimed in Claim 4 wherein the non-diffuser part of the hole comprises a substantially circular cross-section and the diffuser a substantially ovoid cross-section having a pair of semi-circular arcs joined together at their respective ends by a pair of straight parallel sides coincident with opposite sides

of the said circular cross-section.

- 7 A method as claimed in Claim 6 wherein the said angle is determined by the steps of: determining the ratio of the length dimension of the periphery of the said opening and half the length dimension of the opening in the direction of the major axis of the ovoid cross-section; determining a first angle with respect to a minor axis of the said ovoid cross-section by dividing 360 degrees by the said ratio to establish a first position on the periphery of the said circular cross-section, and the step of generating a line between the said first position with a second position on the ovoid at the transition from straight line to circular arc in the quadrant of the arc to be drilled, and determining the angle of the generated line with respect to the major axis of the ovoid.
- 8 A method as claimed in Claim 7 wherein the beam is rotated with respect to the said major axis as it moves between respective transition points on the arcs such that in the plane of the opening the beam is aligned with the major axis when at the mid point of the respective arcs.
- 9 A method as claimed in claim 1 wherein the diffuser angle is between 20-30<sup>0</sup>, preferably 25-29<sup>0</sup>.
- 10 A method as claimed in claim 1 wherein the ratio of the length of the diffuser section to the non-diffuser section is approximately in the region of about 2:1.
- 11 A method as claimed in claim 1 further comprising the step of directing the said beam to cut a further diffuser section on the beam exit side of the hole.
- 12 A method as claimed in claim 1 wherein the said workpiece is a gas turbine engine component.
- 13 A method as claimed in Claim 12 wherein the said component comprises an NGV.

- 14 A method of laser drilling EDM fan type diffuser cooling holes in a gas turbine engine component; the said method comprising the steps of:  
laser drilling a hole of substantially constant cross-section through a wall of the component;  
directing the beam of the laser such that the beam follows a path on at least one side of the hole to drill a diffuser section on at least the beam entry side of the hole with the beam exiting the hole substantially without interference with the remaining non-diffuser part of the hole.
- 15 A gas turbine engine component having at least one cooling hole produced directly or indirectly by the method according to claim 1.